(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 558 853 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 92310377.4

(51) Int. Cl.5: H04N 5/92

(22) Date of filing: 13.11.92

(30) Priority: 04.03.92 JP 47135/92

(43) Date of publication of application:
08.09.93 Bulletin 93/36

(84) Designated Contracting States:
DE FR GB

(71) Applicant: PIONEER VIDEO CORPORATION
No. 2680, Nishihanawa Tatomi-cho
Nakakoma-gun Yamanashi(JP)
Applicant: PIONEER ELECTRONIC CORPORATION
No. 4-1, Meguro 1-chome
Meguro-ku Tokyo 153(JP)

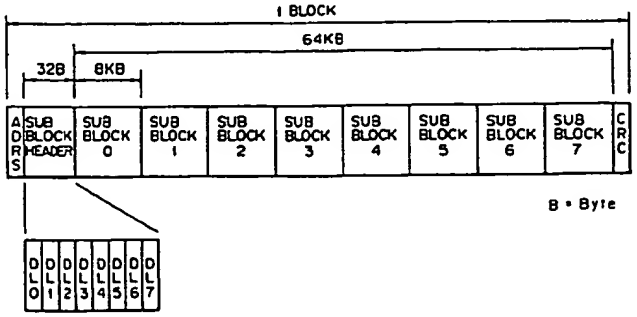
(72) Inventor: Itoh, Naoto, c/o Pioneer Video Corp.
No. 2680, Nishihanawa, Tatomi-cho
Nakakoma-gun, Yamanashi(JP)
Inventor: Nagai, Yoshihisa, c/o Pioneer Video Corp.
No. 2680, Nishihanawa, Tatomi-cho
Nakakoma-gun, Yamanashi(JP)
Inventor: Nomura, Satoru, c/o Pioneer Video Corp.
No. 2680, Nishihanawa, Tatomi-cho
Nakakoma-gun, Yamanashi(JP)

(74) Representative: Tomlinson, Kerry John et al
Frank B. Dehn & Co. European Patent Attorneys Imperial House 15-19 Kingsway
London WC2B 6UZ (GB)

(54) Recording medium and digital video-information recording/reproducing system.

(57) An information recording/reproducing system in which, at the time of information recording, an input digital video signal is divided into a plurality of frequency band components, and information portion data consisting of a predetermined number of sub-block data (subblock 0, subblock 1, etc) with each piece of the digital video signal data per frequency band taken as one subblock data and head portion data (DL0, DL1 etc) including identification data blocks indicating frequency bands for the respective subblocks are recorded as one block on a recording medium. At the time of reproduction, individual pieces of identification data in a header portion are discriminated from the digital video signal, picked up from the recording medium, block by block, and the digital video signal of each subblock is selectively extracted in accordance with the identification data, and the bands of the extracted digital video signals are combined to thereby generate reproduced digital video signals.

Fig. 1



EP 0 558 853 A2

The present invention relates to a recording medium on which a digital video signal is to be recorded, and a system for recording a digital video signal on this recording medium and reproducing the recorded video information possible.

In cases where video information is recorded on a recording medium such as a disk, in reproducing the video information, all the pieces of video signal data or recorded video information are normally reproduced to provide a video image having substantially the same image quality as the one at the time of recording the image. For instance, in playing a recording medium on which high-quality video information of the MUSE (Multiple Sub-Nyquist Sampling Encoding) system is recorded, the high-quality video information cannot be reproduced unless the recording medium is played by a machine which is specially designed for such a recording medium. When an operator wants to obtain high-quality video information at a low image quality, it is reproduced in the form of high-quality video information and is converted into a video image with the quality of, for example, an NTSC video image, by a separate down-converting machine.

The conventional conversion of the image quality is simply to convert the format of a video signal and cannot reproduce video information from a single recording medium with different image qualities and in the same video signal format.

It is therefore an object of the present invention to provide a recording medium which can allow video information to be reproduced with different image qualities in the same video signal format, and an information recording/reproducing system which can handle the same.

According to one aspect of the present invention, there is provided a recording medium on which a digital video signal is recorded in the form of blocks, each block comprising an information portion consisting of a plurality of subblocks, and a header portion including a plurality of identification data blocks located preceding the information portion and respectively associated with said subblocks, each identification data block indicating a frequency band of the recorded digital video signal in the associated one of the subblocks.

On the recording medium embodying the present invention, a plurality of subblocks in each of which a digital video signal is to be recorded are formed in each block, and identification data indicating the frequency bands of the digital video signals of the respective subblocks are respectively recorded in a plurality of identification data blocks, which are located preceding the subblocks in one block and respectively associated with the subblocks.

According to another aspect of the present invention, there is provided an information recording system for recording a digital video signal on a recording medium, comprising means for dividing an input digital video signal into a plurality of frequency band components and generating a group of band digital video signal data; means for producing information portion data consisting of a predetermined number of subblock data with each piece of the band digital video signal data per frequency band taken as one subblock data; means for producing header portion data including identification data blocks indicating frequency bands respectively associated with the subblocks; and means for recording the information portion data and the header portion data as one block on said recording medium.

In the information recording system embodying the present invention, an input digital video signal is divided into a plurality of frequency band components to be a group of band digital video signal data, information portion data consisting of a predetermined number of subblock data with each piece of the band digital video signal data per frequency band taken as one subblock data and header portion data including identification data blocks indicating frequency bands for the respective subblocks are produced, and the information portion data and the header portion data are recorded as one block on the recording medium.

According to a further aspect of the present invention, there is provided an information reproducing system for a recording medium on which a digital video signal has been recorded in the form of blocks, each block comprising an information portion consisting of a plurality of subblocks, and a header portion including a plurality of identification data blocks located preceding the information portion and respectively associated with the subblocks, each identification data block indicating the frequency band of the recorded digital video signal in the associated one of the subblocks, the system comprising reading means for reading the digital video signal from the recording medium; identifying and selecting means for acquiring, block by block, identification data in the header portion from the digital video signal output from the reading means and selectively relaying the digital video signals of the subblocks in accordance with the identification data; and means for, every time digital video signals for a predetermined number of subblocks are relayed from the identifying and selecting means, performing band combination of the relayed digital video signals to thereby generate reproduced digital video signals.

In the information reproducing system embodying the present invention, individual pieces of identification data in the header portion are discrimi-

nated from the digital video signal, read out from a recording medium by the reading means and output therefrom, block by block, and the digital video signal of each subblock is selectively relayed from the identifying and selecting means in accordance with the identification data, and, every time digital video signals for a predetermined number of subblocks are relayed from the identifying and selecting means, the bands of the relayed digital video signals are combined to thereby generate reproduced digital video signals.

According to a yet further aspect of the present invention, there is provided an information recording/reproducing system for recording a digital video signal on a recording medium and reproducing the digital video signal therefrom, comprising: means for dividing an input digital video signal into a plurality of frequency band components and generating a group of band digital video signal data; means for producing information portion data consisting of a predetermined number of subblock data with each piece of said band digital video signal data per frequency band taken as one subblock data; means for producing header portion data including identification data blocks indicating the frequency bands respectively associated with said subblocks; means for recording said information portion data and said header portion data as one block on said recording medium; reading means for reading said digital video signal from said recording medium; identifying and selecting means for acquiring, block by block, identification data in said header portion from said digital video signal output from said reading means and selectively relaying said digital video signals of said subblocks in accordance with said identification data; and means for, every time digital video signals for a predetermined number of subblocks are relayed from said identifying and selecting means, performing band combination of said relayed video digital signals to thereby generate reproduced digital video signals.

A preferred embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Fig. 1 is a diagram illustrating the physical format of one block of a recording medium according to the present invention;

Fig. 2 is a diagram exemplifying the arrangement of subblocks of an audio signal and a video signal on the recording medium embodying the present invention;

Fig. 3 is a block diagram illustrating the structure of an information recording system according to the present invention;

Fig. 4 is a diagram showing effective pixels in one frame;

Fig. 5 is a diagram showing the states before and after DCT transform;

Fig. 6 is a diagram illustrating the results of DCT transform in a two-dimensional frequency plane;

Fig. 7 is a block diagram illustrating the structure of an information reproducing system according to the present invention; and

Fig. 8 is a diagram illustrating frame data before DCT transform in a two-dimensional frequency plane.

Fig. 1 illustrates the structure of one block of a recording medium embodying the present invention. One block consists of an address (ADRS), a subblock header (SUBBLOCK HEADER), eight subblocks (SUBBLOCK) 0 to 7 and an error detection code (CRC: Cyclic Redundancy Check). The address, the foremost element of one block, indicates the position of that block on a track. The subblock header following the address consists of 32 bytes and indicates the types of information signals of the subblocks. The subblock header is therefore divided into eight areas where device labels (DL0 to DL7) as identification data indicating the types of the information signals of the associated subblocks are to be respectively described. The eight subblocks 0 to 7 follow the subblock header in order. The error detection code is located at the end of the block.

On the recording medium, blocks each having such a structure are repeatedly located in the order of their addresses along the track, with a sync signal (not shown in Fig. 1) inserted between consecutive blocks.

Given that the capacity of one subblock is 8 Kbytes, the total capacity of the eight subblocks 0 to 7 becomes 64 Kbytes, as shown in Fig. 1, and the capacity of the subblock header is 32 bytes.

Each of the eight device labels (DL0 to DL7) defines a maximum of 256 types of devices with values of 00H to FFH (H indicates a hexadecimal notation). 00H to FFH may be previously determined as follows.

00H: NULL

01H: SYSTEM 02H-0FH: RESERVED

10H-13H: VIDEO CH1-CH4 14H-1FH: RESERVED

20H-23H: AUDIO CH1-CH4 24H-FFH: RESERVED

NULL represents that the device has no significant meaning and is used when a dummy is necessary in video signal data and audio signal data; the system need not read data from the associated subblock, thus ensuring an efficient operation. SYSTEM stores a control program or the like which is used by the system. VIDEO is video signal data, and AUDIO audio signal data. CH1 to CH4 indicate channel numbers, and RESERVED indicates that the associated subblock is reserved for an information signal which will be set in the future. If the device label DL0 is set as DL0: DEVICE LABEL =

10H, the information signal in the subblock 0 is video signal data of the first channel. With DL1: DEVICE LABEL = 21H, the information signal in the subblock 1 is audio signal data of the second channel.

When an optical disk which can be played at the transfer rate of 4.7 Mbps is used as a recording medium, the digital reproduced signal is output at the rate of nine blocks per sec or 72 subblocks per sec. If 4-channel audio signal data and 4-channel video signal data are allocated on the optical disk, the subblocks would be arranged as shown in Fig. 2. This arrangement is the format in which audio signal data for four channels are assigned to a half of one block with one subblock provided per channel, and video signal data for four channels are assigned to the subsequent 32 subblocks in that block with eight subblocks per channel. In this case, a group of information signals including audio signal data and video signal data both for four channels are repeated in a cycle of 36 subblocks. It is to be noted that the video signal data for four channels is one video image divided into four as will be described later, not four video images assigned as video signal data to the individual channels. The audio signal data for four channels are sounds of independent channels, respectively.

A description will now be given of an information recording system which records audio signal data and video signal data in such a format on a disk.

In the information recording system, 1-channel input digital video signal data is supplied to a video compressing/coding section 1. The video compressing/coding section 1 comprises a sub-sampling circuit 2, an MC + DPCM (DPCM between movement compensation frames) circuit 3, an inter-frame DCT (Discrete Cosine Transform) circuit 4, a selector 5, quantizers 6A to 6D and Huffman coders 7A to 7D. The sub-sampling circuit 2 thins out the input video signal data at a sub-sampling frequency which is, for example, a half the sampling frequency, and outputs the resultant data. The video signal data from the sub-sampling circuit 2 is supplied via the MC + DPCM circuit 3 to the DCT circuit 4. The DCT circuit 4 divides the video signal data into blocks of 8 × 8 pixels, and performs two-dimensional DCT transform for each block. The output of the DCT circuit 4 is connected to the selector 5, which divides the result of the DCT transform into four and distributes the resultant data. The distribution outputs of the selector 5 are connected to the quantizers 6A-6D to which the Huffman coders 7A to 7D are also connected. The video coded data output from the Huffman coders 7A to 7D are held in buffers 8A to 8D, respectively.

Meantime, the digital audio signal data for four channels are respectively supplied to subband coding sections 11A to 11D. The subband coding section 11A comprises a subband dividing filter 41, a quantizer 42, an FFT analyzer 43 and a multiplexer 44. The subband dividing filter 41 divides the digital audio signal data into a plurality of bands, for example, 32 bands, and outputs the resultant data to the quantizer 42 in the order of a lower frequency band. The FFT analyzer 43 prepares coding data from the audio signal data to determine the number of quantizing bits of each band in the quantizer 42. The quantized data output from the quantizer 42 is supplied together with the coding data to the multiplexer 44 where they are formed into audio coded data in a predetermined format. The subband coding sections 11B to 11D are designed in the same manner as the subband coding section 11A. The audio coded data output from the subband coding sections 11A to 11D are held in buffers 12A to 12D, respectively.

The outputs of the buffers 8A to 8D and 12A to 12D are connected to a selector 13 to which an address subblock header data generator 14 is connected. The selector 13 combines the individual pieces of data held in the buffers 8A to 8D and 12A to 12D with the address subblock header data from the address subblock header data generator 14 to prepare subblocked data, and supplies the subblock data to a correction code adding circuit 15. The output of the correction code adding circuit 15 is connected to a modulator 16 whose output signal is supplied via a driver 17 to a recording head 18. A disk 19 on which the video signal data and audio signal data are to be recorded is rotated by a well-known disk driving system (not shown).

In the thus constituted information recording system, digital video signal data in use is YC_RC_B data which is acquired by converting three-color data, RGB (red, green, blue), into a luminance signal component Y and two color difference signal components C_R and C_B. This is a format standardized in Rec. 601 of CCIR (International Radio Consultative Committee). As individual pieces of YUV data are compressed and coded in the aforementioned manner by the above structure, a description will be given only on the luminance signal component Y.

The number of pixels in one frame of the luminance signal component Y after sub-sampling is 858 (horizontal direction) × 525 (vertical direction) as shown in Fig. 4(a). The number of effective pixels in the total pixels is 720 × 480. The 720 × 480 pixels are coded in the movement compensation predicting system in the MC + DPCM circuit 3, and then divided by the DCT circuit 4 into blocks each consisting of 8 × 8 pixels, as shown in Fig. 4-(b). One frame contains 90 × 60 = 5400 divided blocks. The DCT transform is carried out for each block consisting of 8 × 8 pixels. Provided that the

block A in Fig. 4(b) has pixel data Yij (i = 0, 1, ... 7, j = 0, 1, ... 7) of the luminance signal component as shown in Fig. 5(a), the DCT transform of the one block yields DCT transformed data Dk (k = 1, 2, ... 64) as shown in Fig. 5(b). The closer the position of the DCT transformed data Dk to the upper left, then that DCT transformed data Dk represents a lower frequency component. The result of the DCT transform can be viewed as a two-dimensional frequency plane as shown in Fig. 6. The smaller the value of k in the DCT transformed data Dk is, the lower the frequency of that data becomes. The selector 5 thus divides the DCT transformed data Dk into four areas 1 to 4 with different frequency bands and distributes the data accordingly. For instance, D1 to D6 are allocated in the area 1, D7 to D15 in the area 2, D16 to D36 in the area 3 and D37 to D64 in the area 4, as indicated by the thick solid lines in Fig. 6. The data in the area 1 is supplied to the quantizer 6A, the data in the area 2 to the quantizer 6B, the data in the area 3 to the quantizer 6C, and the data in the area 4 to the quantizer 6D. The quantizers 6A to 6D linearly quantize the respective pieces of data in the assigned step sizes using quantizing tables. The quantized pieces of data are transformed into Huffman codes in the Huffman coders 7A to 7D before they are held in the buffers 8A to 8d.

The 4-channel audio signal data is also coded and held in the respective buffers 12A to 12D. To divide the data held in the buffers 8A to 8D and 12A to 12D, therefore, the selector 13 outputs the address data from the address subblock header data generator 14 first, and then outputs the subblock header data. The subblock header data, which serves to determine device labels (DL0-DL7), is set previously. After outputting the subblock header data, the selector 13 outputs the audio signal data of the first channel from the buffer 12A as subblock data A1, the audio signal data of the second channel from the buffer 12B as subblock data A2, the audio signal data of the third channel from the buffer 12C as subblock data A3, and the audio signal data of the fourth channel from the buffer 12D as subblock data A4, in order. Further, the selector 13 sequentially outputs the video signal data of the area 1 from the buffer 8A as subblock data V1, the video signal data of the area 2 from the buffer 8B as subblock data V2, the video signal data of the area 3 from the buffer 8C as subblock data V3, and the video signal data of the area 4 from the buffer 8D as subblock data V4. In other words, the selector 13 outputs the subblock data as indicated by "13a" in Fig. 3. It should be noted that one subblock data is not limited to one subblock, but may span over a plurality of subblocks. The subblocked data signals for each block are supplied to the correction code adding circuit 15 where an error correction code ECC is added for each subblock data as shown by "15a" in Fig. 3. The output signal of the correction code adding circuit 15 is modulated by a modulation system, such as EFM modulation, by the modulator 16. The output signal of the modulator 16 is supplied via the driver 17 to the recording head 18 to be written on the disk 19. If the recording head 18 is of an optical type that uses a semiconductor laser, the video and audio information are recorded on the disk 19 by the irradiated laser beam.

Fig. 7 illustrates a system for reproducing information from a disk on which digital video signal data and audio signal data are recorded. This information reproducing system does not reproduce all the recorded video signal data, but reproduces only the video signal data in the areas 1 and 2. The arrangement of the reproducing system will be described below. A disk 20 is driven by a driving system (not shown), and a pickup head 21 optically picks up the recorded contents from the disk 20. The picked-up RF signal output from the pickup head 21 is supplied to a demodulator 22 where it is demodulated into a digital signal block by block by a demodulating system, such as EFM demodulation. In other words, the demodulator 22 outputs the individual pieces of data in the order of subblocks indicated by "22a" in Fig. 7. The demodulator 22 is connected via an error correcting circuit 23 to a subblock identifying circuit 24.

The error correcting circuit 23 performs error correction only on subblock data V1 and V2 of the video signal data as indicated by "23a" in Fig. 7, and will not output subblock data V3 and V4, disregarding them. The subblock identifying circuit 24 identifies the contents of the individual device labels (DL0-DL7) in the subblock header for each block using, for example, a table and distributes the subblocks at the timing according to the sync signal. The subblock identifying circuit 24 is provided with distribution output terminals, which include audio outputs A1 to A4, and video outputs V1 and V2. When the subblock identifying circuit 24 identifies the digital signal from the error correcting circuit 23 and when the content of the identified device label is DL0: DEVICE LABEL = 20H, the digital signal in the subblock 0 is supplied as a digital audio signal of the first channel from the audio output A1. When the content of the identified device label is DL1: DEVICE LABEL = 21H, the digital signal in the subblock 0 is supplied as a digital audio signal of the second channel from the audio output A2. The same is applied to the subblocks 2 and 3. When the content of the identified device label is DL4: DEVICE LABEL = 10H, the digital signal in the subblock 4 is output as a digital video signal of the first channel (area 1) from the video output V1. With DL5: DEVICE LABEL = 11H,

the digital signal in the subblock 5 is output as a digital video signal of the second channel (area 2) from the video output V2.

Some modification may be made so that the error correcting circuit 23 performs error correction on all the subblock data V1 to V4 of the video signal data while the subblock identifying circuit 24 outputs only the subblock data V1 and V2 of the video signal data after the error correction in accordance with the content of the identified device label.

The audio outputs A1 to A4 are connected via buffers 25A to 25D to subband decoding sections 26A to 26D, respectively. The subband decoding section 26A comprises a format selector 27, an inverse quantizer 28, a decode data discriminator 29 and a multiplier 30. The format selector 27 selects the audio signal component data and the decode data from the digital audio signal data held in the buffer 25A and outputs those data. The selected decode data is supplied to the decode data discriminator 29, which discriminates the number of quantizing bits at the time of the data coding and to which subband the data belongs, on the basis of the decode data. The inverse quantizer 28 performs inverse quantization of the audio signal component data in accordance with the output signal of the decode data discriminator 29 for each subband to decode the original amplitude level to data and sends the resultant data to the multiplier 30. The multiplier 30 combines the decoded data of the individual subbands to transform it into a full-band audio decoded data in accordance with the output signal of the decode data discriminator 29. The subband decoding sections 26B to 26D are designed in the same way as the subband decoding section 26A. The audio decoded data output from each of the subband decoding sections 26A to 26D is a digital audio reproduced signal.

The video outputs V1 and V2 are connected via buffers 31A and 31B to a video expanding/decoding section 32. The video expanding/decoding section 32 comprises Huffman decoders 33A and 33B, inverse quantizers 34A and 34B, a combining circuit 35, an inter-frame inverse DCT circuit 36, an inverse MC+DPCM circuit 37 and a sub-sampling interpolating circuit 38. The video expanding/decoding section 32 performs an operation reverse to that of the aforementioned compressing/coding section 1.

The digital video signal data output from the video output V1 is held in the buffer 31A. The digital video signal data is supplied to the inverse quantizer 34A after being decoded by the Huffman decoder 33A. The inverse quantizer 34A performs inverse quantization of the decoded video signal data using a quantizing table. The digital video signal data output from the video output V2 is likewise processed by the Huffman decoder 33B and the inverse quantizer 34B. The individual pieces of inverse-quantized video signal data are arranged in the order of areas 1 and 2 in the combining circuit 35 to become block-by-block data. The data for one frame, when expressed in a two-dimensional frequency plane, becomes as shown in Fig. 8; only the areas 1 and 2 contain data while the areas 3 and 4 contain no data so that data becomes all zero. The output signal of the combining circuit 35 is subjected to inverse DCT transform in the inter-frame inverse DCT circuit 36 for each block consisting of 8 × 8 pixels. The resultant signal is then supplied to the inverse MC+DPCM circuit 37. The inverse MC+DPCM circuit 37 decodes the data undergone the inverse DCT transform, in the movement compensation predicting system, yielding video signal data consisting of 720 × 480 pixels. This video signal data is interpolated by the sub-sampling interpolating circuit 38, and the resultant signal is output as a reproduced digital video signal.

Although the video signal data of only the areas 1 and 2 are reproduced in the above-described embodiment, the present invention is not restricted to the particular type. For example, if the video signal data are written in the all the areas 1 to 4, the video signal data of all the areas 1 to 4 may of course be reproduced, or if the video signal data are written in the areas 1 to 3, the video signal data of the areas 1 to 3 may be reproduced. A switch may be provided to select from which one of the areas 1-4 data should be reproduced, so that data of the selected area alone can be reproduced according to the selection.

Further, the arrangement for separating the digital video signal into a plurality of frequency bands is not limited to the one described above. For instance, a plurality of BPFs may be used to divide the digital video signal.

Further, although the recording medium has been described as a disk in the foregoing description, it is in no way limited to this particular type, but the present invention may be adapted for other types of recording media such as a tape and a card.

In short, according to the present invention, at the time information is recorded on a recording medium, an input digital video signal is divided into a plurality of frequency band components to be a group of band digital video signal data, information portion data consisting of a predetermined number of subblock data with each piece of the band digital video signal data per frequency band taken as one subblock data and header portion data including identification data blocks indicating frequency bands for the respective subblocks are produced, and the information portion data and the header

portion data are recorded as one block on the recording medium. At the time information is reproduced from the recording medium, individual pieces of identification data in the header portion are discriminated from the digital video signal, read out from the recording medium, block by block, and the digital video signal of each subblock is extracted in accordance with the identification data, and, every time digital video signals for a predetermined number of subblocks are extracted, the bands of the extracted digital video signals are combined to thereby generate reproduced digital video signals.

At the reproduction time, therefore, video information can be reproduced from the same recording medium with the image quality determined by the specification of the reproducing system or an arbitrary image quality and in the same video signal format. If the reproducing system is used to see pictures, for example, a high-image quality specification to reproduce the full band of the recorded digital video signal should be used. With the reproducing system used for news reports, a low-image quality specification to reproduce a partial band of the recorded digital video signal may be used. In this manner, the reproducing system can be selected according to the purpose of the usage. The present invention is therefore advantageous in permitting a user to select a low-cost reproducing system with a low-image quality specification rather than an expensive reproducing system with a high-image quality specification when the latter is not particularly needed.

Claims

1. A recording medium on which a digital video signal is recorded in the form of blocks, each block comprising an information portion consisting of a plurality of subblocks, and a header portion including a plurality of identification data blocks located preceding said information portion and respectively associated with said subblocks, each identification data block indicating the frequency band of said recorded digital video signal in the associated one of said subblocks.

2. An information recording system for recording a digital video signal on a recording medium (19), comprising:

means (1) for dividing an input digital video signal into a plurality of frequency band components and generating a group of band digital video signal data;

means (13) for producing information portion data consisting of a predetermined number of subblock data with each piece of said band digital video signal data per frequency band taken as one subblock data;

means (14) for producing header portion data including identification data blocks indicating the frequency bands respectively associated with said subblocks; and

means (18) for recording said information portion data and said header portion data as one block on said recording medium (19).

3. An information reproducing system for a recording medium (20) on which a digital video signal has been recorded in the form of blocks, each block comprising an information portion consisting of a plurality of subblocks, and a header portion including a plurality of identification data blocks located preceding the information portion and respectively associated with the subblocks, each identification data block indicating the frequency band of the recorded digital video signal in the associated one of the subblocks, the system comprising:

reading means (21) for reading said digital video signal from said recording medium;

identifying and selecting means (24) for acquiring, block by block, identification data in said header portion from said digital video signal output from said reading means (21) and selectively relaying said digital video signals of said subblocks in accordance with said identification data; and

means (22) for, every time digital video signals for a predetermined number of subblocks are relayed from said identifying and selecting means, performing band combination of said relayed digital video signals to thereby generate reproduced digital video signals.

4. An information recording/reproducing system for recording a digital video signal on a recording medium (19,20) and reproducing the digital video signal therefrom, comprising:

means (1) for dividing an input digital video signal into a plurality of frequency band components and generating a group of band digital video signal data;

means (13) for producing information portion data consisting of a predetermined number of subblock data with each piece of said band digital video signal data per frequency band taken as one subblock data;

means (14) for producing header portion data including identification data blocks indicating the frequency bands respectively associated with said subblocks;

means (18) for recording said information portion data and said header portion data as one block on said recording medium;

reading means (21) for reading said digital video signal from said recording medium;

identifying and selecting means (24) for acquiring, block by block, identification data in said header portion from said digital video signal output from said reading means and selectively relaying said digital video signals of said subblocks in accordance with said identification data; and

means (32) for, every time digital video signals for a predetermined number of subblocks are relayed from said identifying and selecting means, performing band combination of said relayed digital video signals to thereby generate reproduced digital video signals.

5. A recording system as claimed in claim 2, wherein the means (1) for dividing the input digital video signal into a plurality of frequency band components comprises:

means (4) to convert the input digital video signal data into a plurality of blocks, each block comprising a plurality of pixels, and to transform the data in each block, whereby pixels of transformed data having similar frequencies are located in proximity to one another in the transformed block;
and

means (5) to divide the transformed block into regions with different frequencies such that the input digital video signal is divided in a plurality of frequency band components.

6. A reproducing system as claimed in claim 3, wherein said means (32) for performing band combination of said relayed digital video signals comprises:

means to combine the relayed digital video signals to form blocks of data comprising a plurality of pixels, in which pixels of data having similar frequencies are located in proximity to one another in a block; and

means (36) to transform the data in each block to generate reproduced digital video signals.

7. A recording/reproducing system as claimed in claim 4, wherein the means (1) for dividing the input digital video signal into a plurality of frequency band components comprises:

means (4) to convert the input digital video signal data into a plurality of blocks, each block comprising a plurality of pixels, and to transform the data in each block, whereby pixels of transformed data having similar frequencies are located in proximity to one another in the transformed block;
and

means (5) to divide the transformed block into regions with different frequencies such that the input digital video signal is divided in a plurality of frequency band components; and

said means (32) for performing band combination of said relayed digital video signals comprises:

means to combine the relayed digital video signals to form blocks of data comprising a plurality of pixels, in which pixels of data having similar frequencies are located in proximity to one another in a block; and

means (36) to transform the data in each block to generate reproduced digital video signals.

Fig. 1

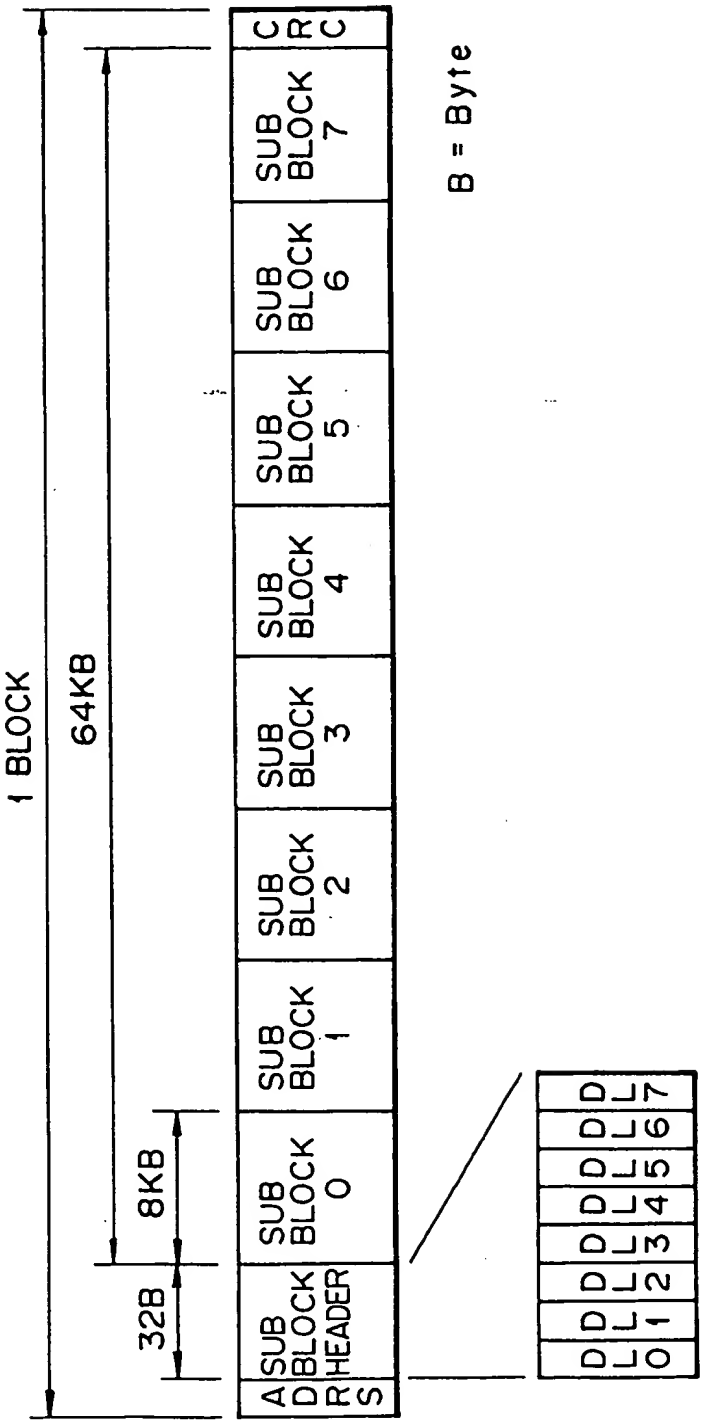

1 BLOCK
64KB
8KB
32B
ADDRS
SUB BLOCK HEADER
SUB BLOCK 0
SUB BLOCK 1
SUB BLOCK 2
SUB BLOCK 3
SUB BLOCK 4
SUB BLOCK 5
SUB BLOCK 6
SUB BLOCK 7
CRC
B = Byte
DLL 0
DLL 1
DLL 2
DLL 3
DLL 4
DLL 5
DLL 6
DLL 7

Fig. 2

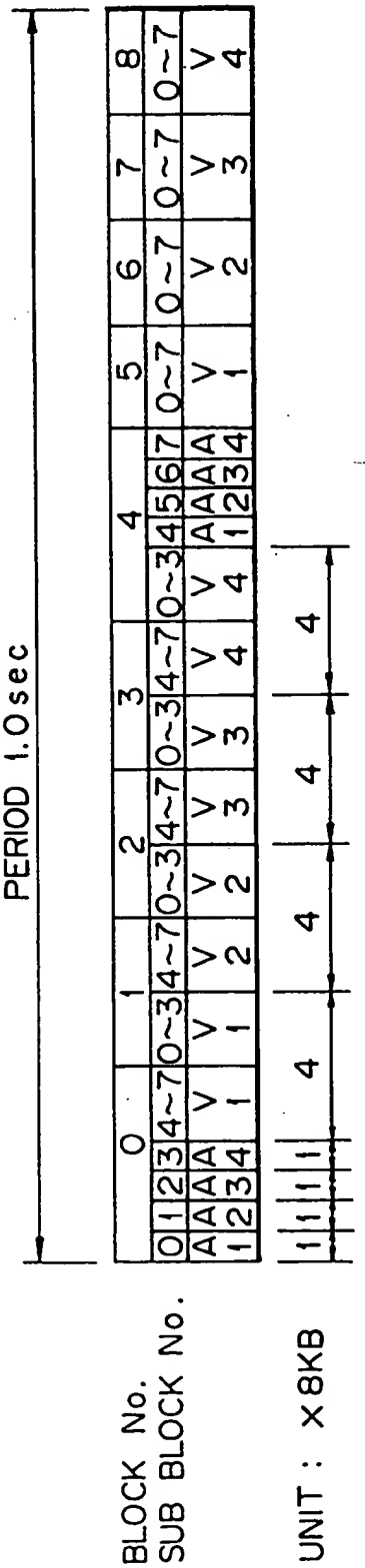


Fig. 3

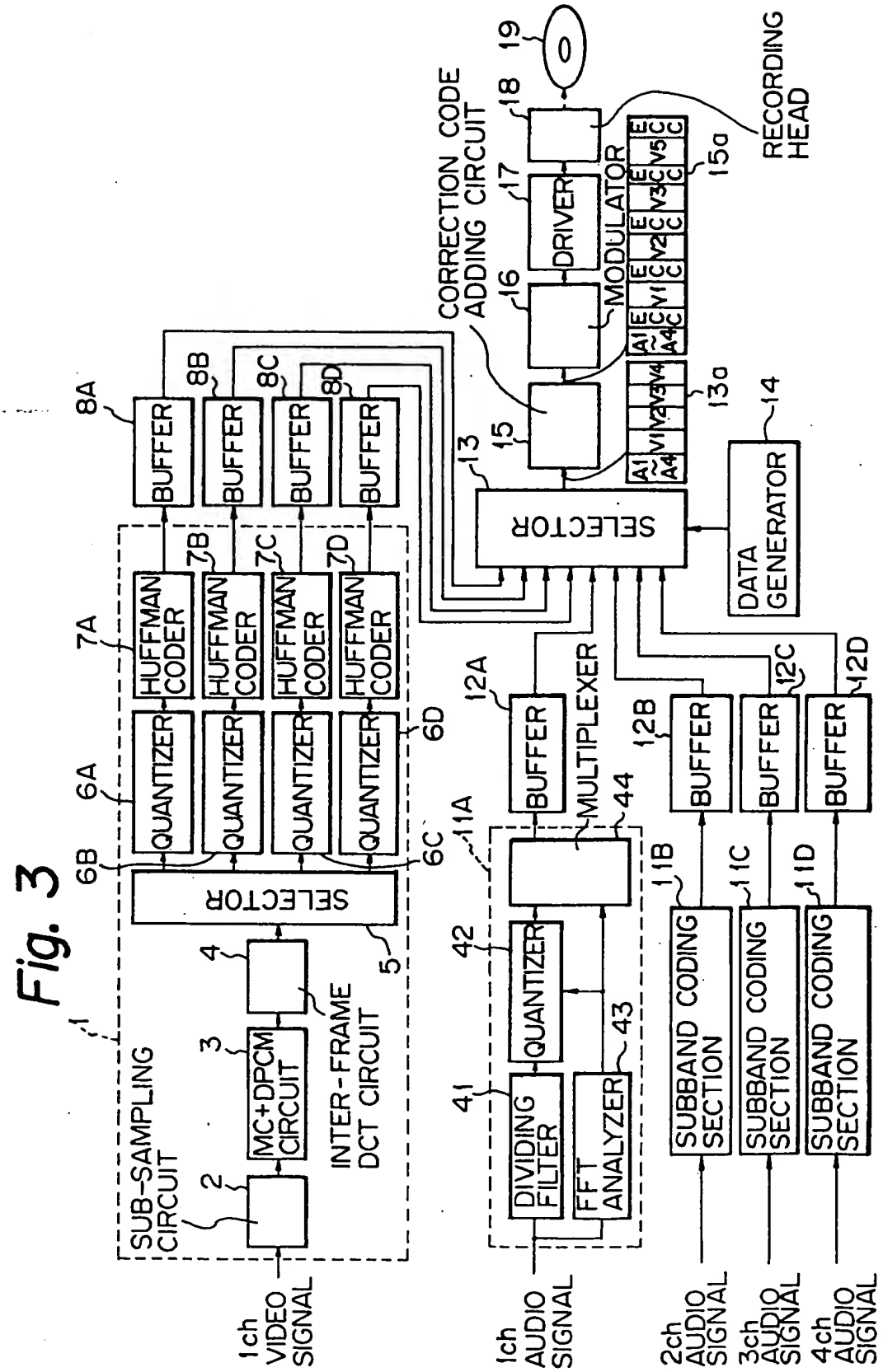

1ch VIDEO SIGNAL
SUB-SAMPLING CIRCUIT
INTER-FRAME DCT CIRCUIT
MC+DPCM CIRCUIT
SELECTOR
QUANTIZER
HUFFMAN CODER
BUFFER
1ch AUDIO SIGNAL
DIVIDING FILTER
FFT ANALYZER
QUANTIZER
MULTIPLEXER
BUFFER
SUBBAND CODING SECTION
2ch AUDIO SIGNAL
3ch AUDIO SIGNAL
4ch AUDIO SIGNAL
SELECTOR
DATA GENERATOR
CORRECTION CODE ADDING CIRCUIT
MODULATOR
DRIVER
RECORDING HEAD

Fig. 4(b)

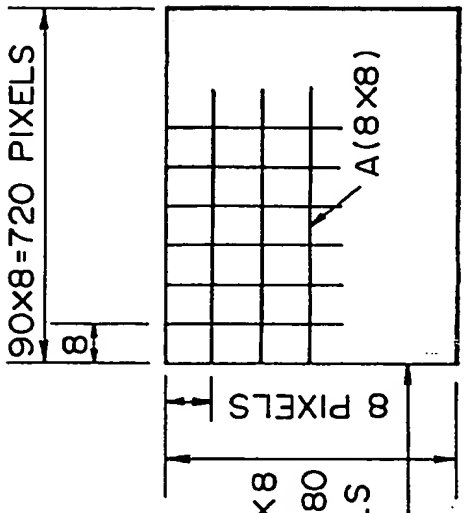

90X8=720 PIXELS
8
A(8X8)
8 PIXELS
60X8
=480
PIXELS

Fig. 4(a)

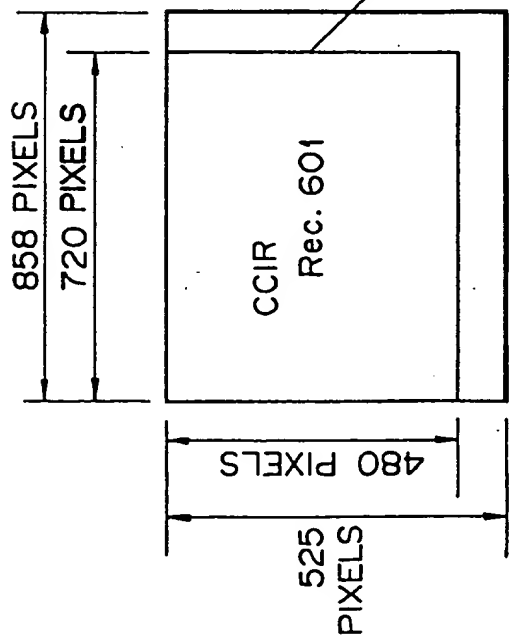

858 PIXELS
720 PIXELS
CCIR
Rec. 601
480 PIXELS
525
PIXELS

Fig. 5(a)

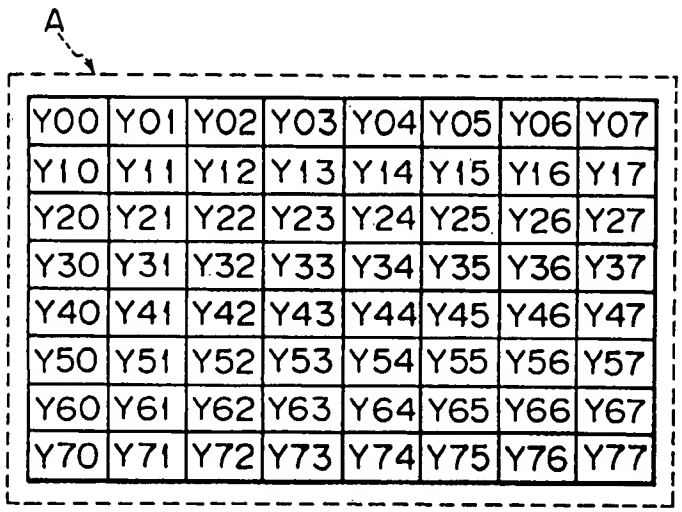


Fig. 5(b)

D1	D2	D6	D7	D15	D16	D28	D29
D3	D5	D8	D14	D17	D27	D30	D43
D4	D9	D13	D18	D26	D31	D42	D44
D10	D12	D19	D25	D32	D41	D45	D54
D11	D20	D24	D33	D40	D46	D53	D55
D21	D23	D34	D39	D47	D52	D56	D61
D22	D35	D38	D48	D51	D57	D60	D62
D36	D37	D49	D50	D58	D59	D63	D64

EP 0 558 853 A2

Fig. 6

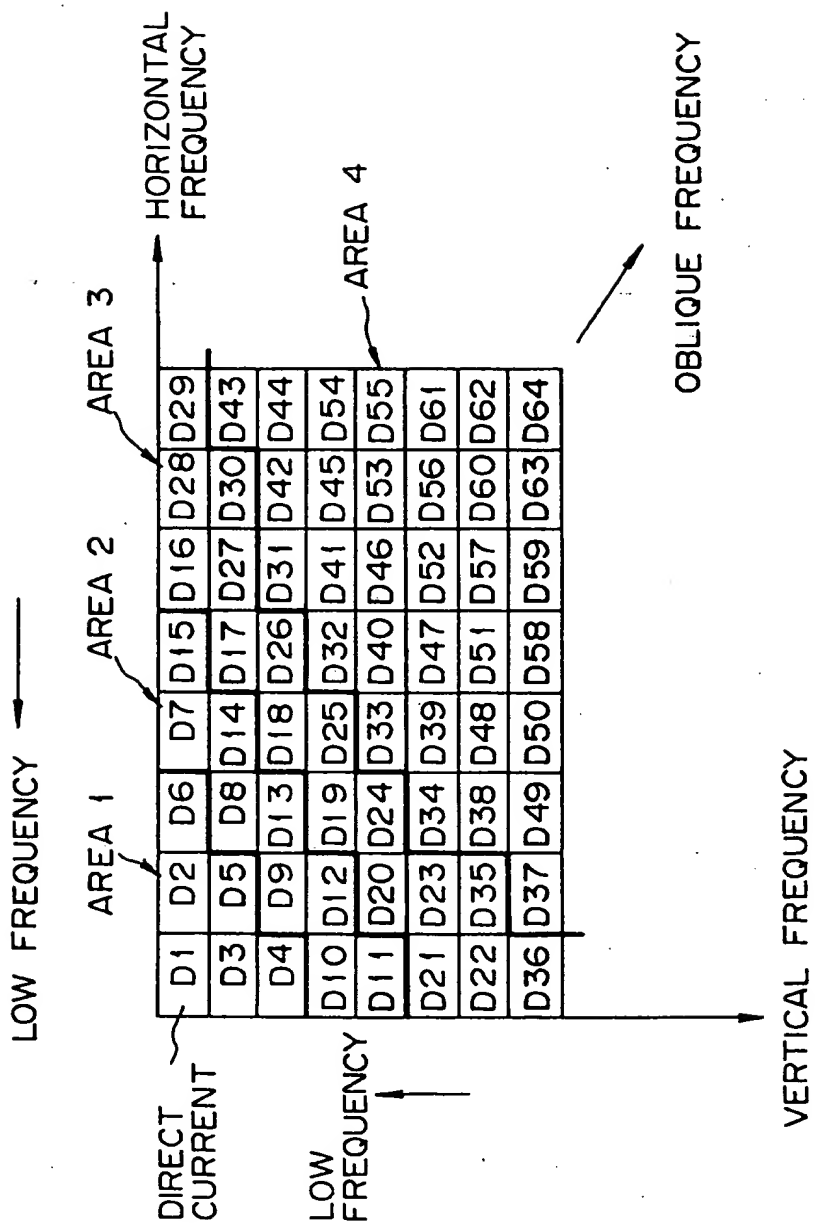

LOW FREQUENCY
AREA 1
AREA 2
AREA 3
AREA 4
HORIZONTAL FREQUENCY
OBLIQUE FREQUENCY
VERTICAL FREQUENCY
DIRECT CURRENT
LOW FREQUENCY
D1 D2 D6 D7 D15 D16 D28 D29
D3 D5 D8 D14 D17 D27 D30 D43
D4 D9 D13 D18 D26 D31 D42 D44
D10 D12 D19 D25 D32 D41 D45 D54
D11 D20 D24 D33 D40 D46 D53 D55
D21 D23 D34 D39 D47 D52 D56 D61
D22 D35 D38 D48 D51 D57 D60 D62
D36 D37 D49 D50 D58 D59 D63 D64

Fig. 7

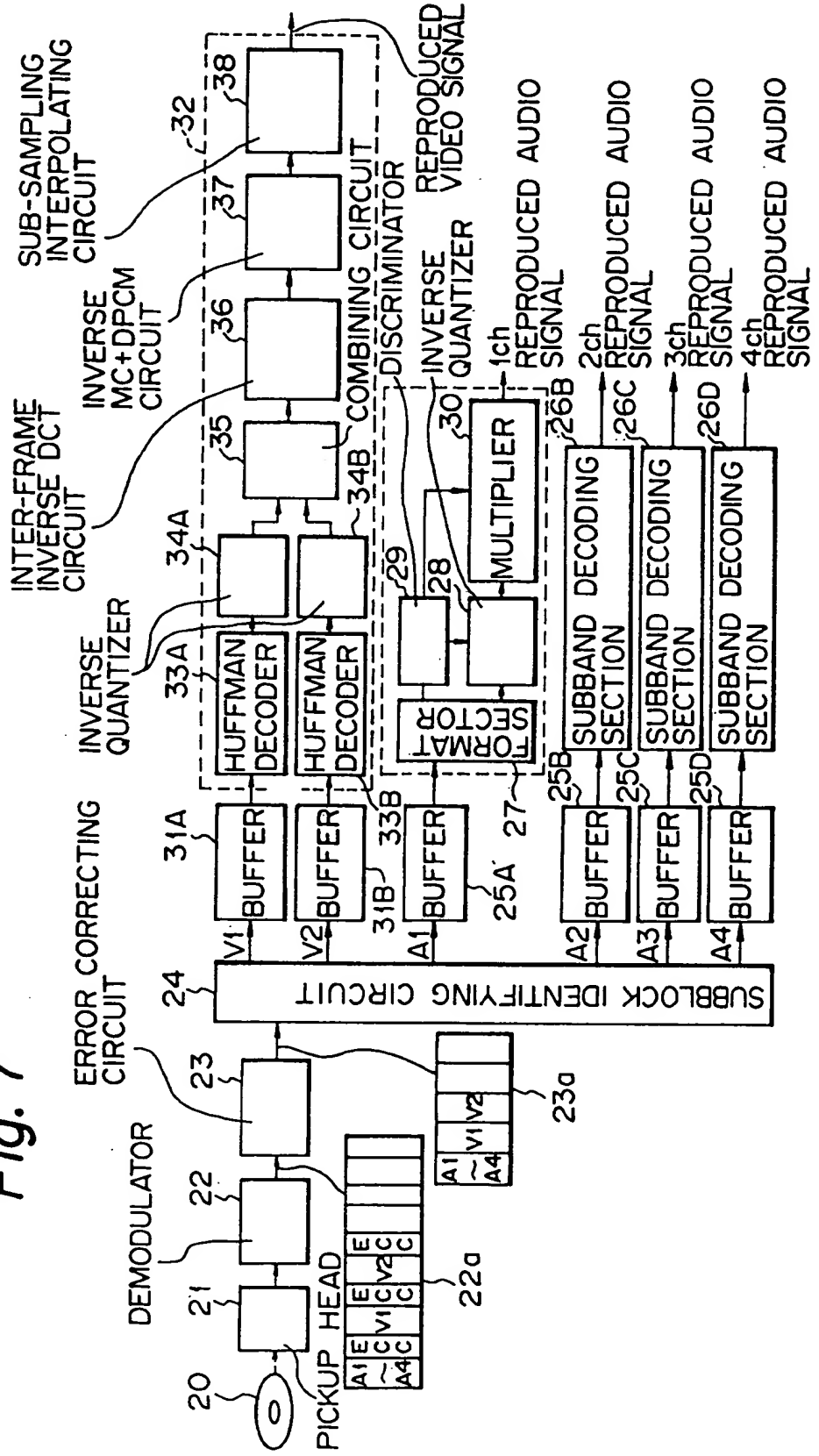
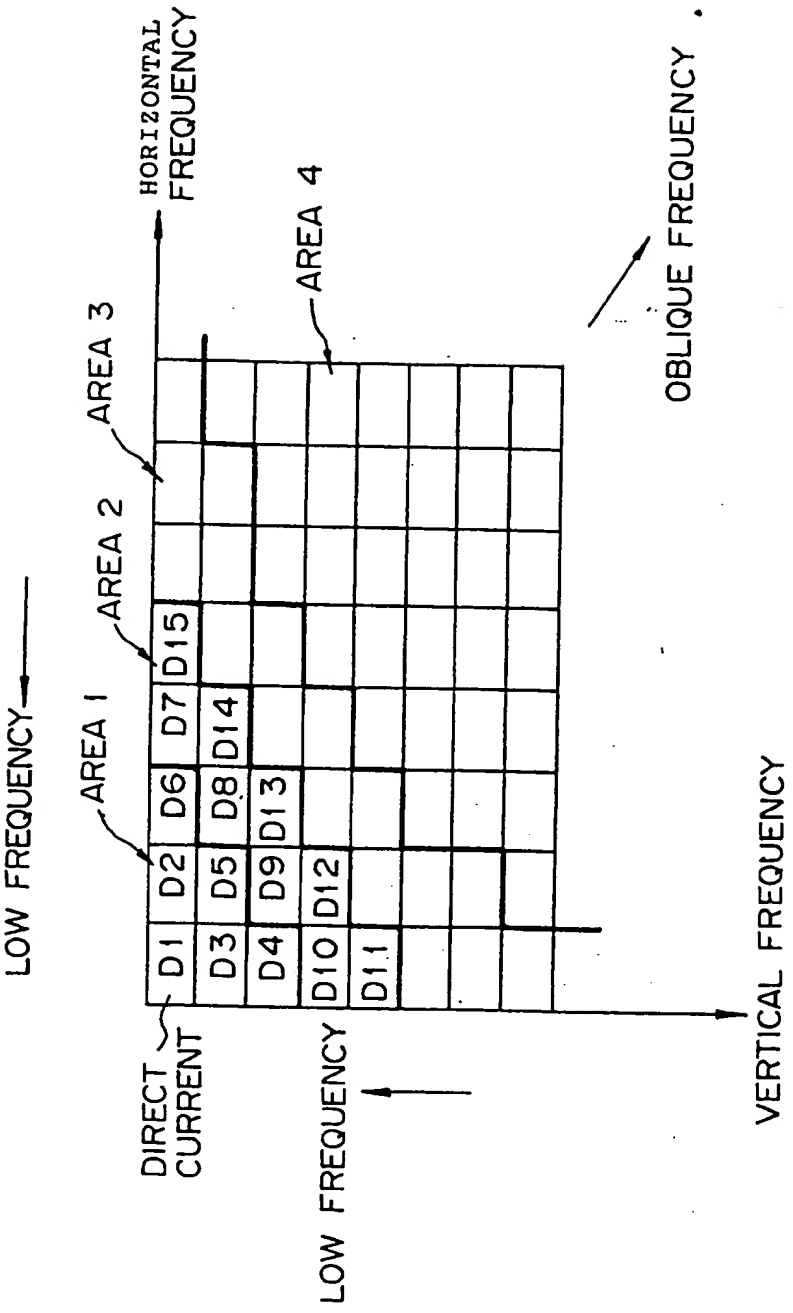

PICKUP HEAD
DEMODULATOR
ERROR CORRECTING CIRCUIT
SUBBLOCK IDENTIFYING CIRCUIT
BUFFER
HUFFMAN DECODER
INVERSE QUANTIZER
INTER-FRAME INVERSE DCT CIRCUIT
INVERSE MC+DPCM CIRCUIT
SUB-SAMPLING INTERPOLATING CIRCUIT
COMBINING CIRCUIT
DISCRIMINATOR
INVERSE QUANTIZER
MULTIPLIER
FORMATTER
SUBBAND DECODING SECTION
REPRODUCED VIDEO SIGNAL
1ch REPRODUCED AUDIO SIGNAL
2ch REPRODUCED AUDIO SIGNAL
3ch REPRODUCED AUDIO SIGNAL
4ch REPRODUCED AUDIO SIGNAL

Fig. 8


LOW FREQUENCY
AREA 1
AREA 2
AREA 3
AREA 4
HORIZONTAL FREQUENCY
OBLIQUE FREQUENCY
VERTICAL FREQUENCY
LOW FREQUENCY
DIRECT CURRENT
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15

(19) JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: 02023574 A

(43) Date of publication of application: 25.01.90

(51) Int. Cl G11B 20/10

(21) Application number: 63172299

(22) Date of filing: 11.07.88

(71) Applicant: VICTOR CO OF JAPAN LTD

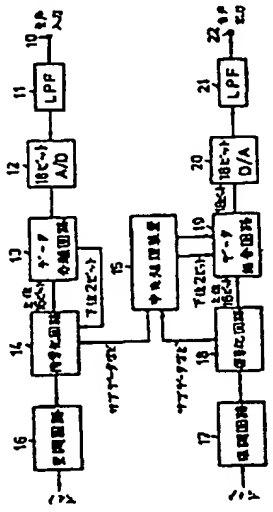
(72) Inventor: INOUE YASUO

(54) SOUND DATA RECORDING AND REPRODUCING DEVICE

(57) Abstract:

PURPOSE: To reduce quantized noises so as to improve the quality of sound data by recording analog sound signals in different areas of the track of a magnetic tape after converting the signals into sound data having (n) bits of quantized bits and dividing the quantized bits into higher-rank (m) bits and lower-rank (n-m) bits and coupling and D/A converting the sound data at the time of reproduction.

CONSTITUTION: Analog sound signals at an input terminal 10 are quantized to 18 bits quantized bits by means of an 18-bit A/D converter 12. Then each 18 bits are separated into higher-rank 16 bits and lower-rank 2 bits by means of a data separation circuit 13 and the higher-rank 16 bits are supplied as sound data to an encoding circuit 14. The lower-rank 2 bits are also supplied to the circuit 14 as sub-code data together with sub-code signals from a CPU. The circuit 14 records these data in the sound data and sub-code areas of a magnetic tape as one block through a modulator circuit 16. At the time of reproduction, the higher- and lower-rank bits are coupled together by means of a data coupling circuit 19 after the bits are respectively decoded and outputted as 18 bits after D/A conversion. Therefore, quantization noises are reduced.



⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平2-23574

⑤Int.Cl.⁵	識別記号	庁内整理番号	㊸公開　平成2年(1990)1月25日
G 11 B 20/10	341 Z	7923-5D	

審査請求　未請求　請求項の数 1　(全6頁)

㊹発明の名称　音声データ記録再生装置

㉑特　願　昭63-172299
㉒出　願　昭63(1988)7月11日

㉗発明者　井上　靖夫　神奈川県横浜市神奈川区守屋町3丁目12番地　日本ビクター株式会社内
㉗出願人　日本ビクター株式会社　神奈川県横浜市神奈川区守屋町3丁目12番地
㉔代理人　弁理士 伊東　忠彦　外1名

明細書

1. 発明の名称

音声データ記録再生装置

2. 特許請求の範囲

アナログ音声信号を量子化ビット数nビット(ただし、nは3以上の整数)の音声データに変換して出力するnビットA/D変換器と、

前記量子化ビット数nビットの音声データの夫々を上位mビット(ただし、mは2以上の整数で、m<n)と下位(n-m)ビットとに夫々分離するデータ分離回路と、

量子化ビット数mビットの音声データを磁気テープ上のトラックの第1の領域に記録し、サブコード信号を同じトラックの別の第2の領域に記録する既存の音声データ記録再生装置と同様に上記第1の領域に上記分離された上位mビットの各データを記録し、かつ、上記第2の領域に上記分離された下位(n-m)ビットの各データと該下位(n-m)ビットの各データが該第2の領域に記録されていることを示す識別情報とを夫々記録する記録手段とを記録系に具備し、

上記第1及び第2の領域に記録された各信号を夫々再生する再生手段と、

上記再生手段よりの再生信号中の前記識別情報に基づき、前記第1の領域から再生された前記上位mビットの各データに前記第2の領域から再生された前記下位(n-m)ビットの各データを結合して量子化ビット数nビットの音声データを得る動作を行なうデータ結合回路と、

上記データ結合回路から取り出された上記量子化ビット数nビットの音声データをアナログ音声信号に変換するnビットD/A変換器とを再生系に具備することを特徴とする音声データ記録再生装置。

3. 発明の詳細な説明

産業上の利用分野

本発明は音声データ記録再生装置に係り、特に音声データと他のディジタル情報信号とを同じトラックの別々の領域に記録し、それを再生する音声データ記録再生装置に関する。

従来の技術

アナログオーディオ信号をパルス符号変調（ＰＣＭ）して得られたＰＣＭ音声データを同期信号やＩＤコード，アドレス，パリティなどに時分割多重してなるブロック単位で合成し，これに音声データ以外のディジタル情報信号などからなるサブコード信号やトラッキング信号を更に時分割多重して得た信号を回転ヘッドにより磁気テープ上に記録し，これを再生するディジタル・オーディオ・テープレコーダ（以下，「ＤＡＴ」と記す）が知られている。

第３図はこのＤＡＴにより記録形成された１本のトラックの構成を示す。同図中，磁気テープ１上に回転ヘッドにより記録された１本のトラック２は回転ヘッドの走査方向に，サブコード領域３ａ，ＡＴＦ領域４ａ，ＰＣＭ領域５，ＡＴＦ領域４ｂ，サブコード領域３ｂの順に配置され，かつ，各領域間にはインターブロックギャップ（ＩＢＧ）が設けられている。サブコード領域３ａ，３ｂは夫々８ブロック，トラッキング信号が記録されているＡＴＦ領域４ａ，４ｂは各々５ブロック、ＰＣＭ領域５は 128ブロックで、１本のトラックは 196ブロックから構成されている。

ＰＣＭ領域５を構成する 128ブロックの各々は第４図に示す如く、８ビットの同期信号、各８ビットの信号Ｗ１，Ｗ２，パリティ，そして全部で 256ビット（＝３２シンボル）のＰＣＭ音声データ及びパリティが時系列的に合成されている。また、Ｗ１は主としてフォーマットＩＤやフレームアドレスを示すＩＤコードであり、Ｗ２は１本のトラックのＰＣＭ領域５の何ブロック目であるかを示すブロックアドレスである。

また、サブコード領域３ａ，３ｂを構成する全部で１６ブロックの各々は第５図に示す如く、各８ビットの同期信号、ＳＷ１，ＳＷ２及びパリティと 256ビットのサブコードデータ及びそのパリティとが時系列的に合成された信号フォーマットとされており、１ブロックのビット数は上記ＰＣＭ領域５のブロックと同一である。なお、第５図においてＳＷ１は主としてデータＩＤやプログラムナンバーで、またＳＷ２はサブコードＩＤとブロックアドレスとからなる。

かかる信号フォーマットのトラックを順次に形成するＤＡＴにおいて、ＰＣＭ音声データは２チャンネル（ｃｈ）のアナログ音声信号を４８kHzで標本化し、それを量子化ビット数１６ビットで直線量子化したものが標準モードとして定められているが、これ以外にも標本化周波数44.1kHzで１６ビット直線量子化２ｃｈ，標本化周波数３２kHzで１６ビット直線量子化２ｃｈ，標本化周波数３２kHzで１２ビット折線量子化２ｃｈ，標本化周波数３２kHzで１２ビット折線量子化４ｃｈの各モードが定められている。

発明が解決しようとする課題

しかるに、従来は量子化ビット数が最高でも１６ビット直線量子化までしかなく、より量子化ノイズの少ない高品質の音声データの記録再生ができなかった。

本発明は上記の点に鑑みてなされたもので、既存の装置による互換再生を確保しつつ、より高品質な再生ができる音声データ記録再生装置を提供することを目的とする。

課題を解決するための手段

本発明の音声データ記録再生装置は、ｎビットＡ／Ｄ変換器と、量子化ビット数ｎビットの音声データの夫々を上位ｍビット（ただし、ｍは２以上の整数でｍ＜ｎ）と下位（ｎ－ｍ）ビットとに夫々分離するデータ分離回路と、トラックの第１の領域に上記上位ｍビットの各データを記録し、第２の領域に上記下位（ｎ－ｍ）ビットの各データを記録する記録手段とを記録系に具備し、再生手段と、上記第１，第２の各領域の再生データを結合して量子化ビット数ｎビットの音声データを得る動作を行なうデータ結合回路と、ｎビットＤ／Ａ変換器とを再生系に具備するよう構成したものである。

作用

Ａ／Ｄ変換器より取り出された量子化ビット数ｎビットの音声データ夫々はデータ分離回路により上位ｍビットと下位（ｎ－ｍ）ビットとに分離

され、記録手段により前者は磁気テープ上順次に形成されるトラックの第１の領域に、また後者と識別情報は同じトラックの別の第２の領域に夫々記録される。

ここで、上記第１の領域は既存の音声データ記録再生装置により量子化ビット数ｍビットの音声データが記録される領域であり、また上記第２の領域はサブコード信号が記録される領域である。

上記の記録手段により磁気テープ上に記録された信号は再生手段により再生され、再生識別情報に基づき、第１の領域の再生データと第２の領域の再生データとを結合するように動作するデータ結合回路により量子化ビット数ｎビットの音声データとされる。この量子化ビット数ｎビットの音声データはＤ／Ａ変換器でアナログ音声信号に変換される。

また、上記の記録手段により磁気テープ上に記録された信号を前記既存の音声データ記録再生装置で再生した場合は、前記第１の領域から支障なく上位ｍビットの各データが音声データとして再生され、Ｄ／Ａ変換される。

実施例

第１図は本発明の一実施例のブロック系統図を示す。同図中、入力端子１０に入来した２チャンネルのアナログ音声信号は低域フィルタ（ＬＰＦ）１１により折り返し成分となるような不要高周波数成分を除去された後、１８ビットＡ／Ｄ変換器１２に供給され、ここで標本化周波数４８kHzで標本化後、量子化ビット数１８ビット（すなわちｎ＝１８）に量子化された音声データに変換される。

この音声データはデータ分離回路１３に供給され、ここでその上位１６ビット（すなわちｍ＝１６）と下位２ビットとに分離される。上位１６ビットの各データは既存のＤＡＴの音声データと同様の音声データとして符号化回路１４に供給される。一方、上記下位２ビットの各データは既存のＤＡＴのサブコードデータとして符号化回路１４に供給される。

また、既存のＤＡＴにおいてサブコード領域に記録されるサブコード信号（例えばアブソリュート・タイム、プログラムタイムなどのサブデータ）は、ＰＣＭ領域にオプショナルコードとして記録されるＡＣ（オグジュアリ・コード）やＳＣ（サーチ・コード）に記録されるべく、中央処理装置１５より符号化回路１４へ供給される。また、中央処理装置１５からは下位２ビットデータをサブコード領域に記録することを示す識別情報も符号化回路１４に供給される。

符号化回路１４は上記の各入力データに対して夫々１フレーム（これは２トラック記録時間で、３０ｍｓ）で完結するインターリーブや誤り訂正符号（パリティ）の付加などを行ない、前記上位１６ビットの各データ及びサブデータを第４図に示した信号フォーマットで１ブロック単位で出力し、また前記下位２ビットの各データを第５図に示した信号フォーマット中、サブコードデータの代りに上記下位２ビットの各データが配置された信号フォーマットで１ブロック単位で出力する。

ここで、上記の下位２ビットの各データは１フレーム時間当り全部で 720バイト（＝４８kHz×２チャンネル×２ビット×３０ｍｓ）ある。これに対し、既存のＤＡＴにより規定されているサブコード領域３ａ，３ｂに記録される全データは、１フレーム期間（２トラック）では 896バイト（＝（３２＋２４）バイト×（16/2）ブロック×２トラック）で、上記 720バイトより大である。

また既存のＤＡＴで規定されているパックフォーマットの場合は１パックは８バイトからなり、また２ブロック当り８パック記録され、そのうち１パックはすべてパリティであり、かつ、１パック中の１バイトはパリティである。従って、パックフォーマットの場合、１フレームの全データは 784バイト（＝７パック×７バイト×（16/2）ブロック×２トラック）で、上記 720バイトより大である。

従って、上記の下位２ビットの各データはサブコード領域にパックフォーマット又はその他のフォーマットで容量に余裕をもって記録される。

なお、前記識別情報は第５図に示したコードＳ

W1の下位4ビットのデータIDの値が、現在はオール"0"がオーディオ用であることが規定されているだけなので、このデータIDとしてオール"0"以外の所定の値で記録される。

符号化回路14より所定の信号フォーマットで順次に取り出されたデータは変調回路16に供給され、ここで再生周波数帯域を狭くし、波形等化を行ない易くするために、8－10変調されて8ビットのデータが10ビットに変換されて出力され、更に所定の経路を経て回転ヘッドに供給され、磁気テープ上に第3図に示すトラックを順次に形成して記録される。

ただし、本実施例では第3図のPCM領域5に前記上位16ビットの各データとサブデータが記録され、サブコード領域3a，3bに前記下位2ビットの各データと前記識別情報とが夫々記録される。また、第1図では省略したが、ATF信号は既存のDATと全く同様に記録される。

ここで、サブコード領域3a，3bに記録される前記下位2ビットの各データをパックフォーマットで記録する場合は、下位2ビットの各データは第2図に示す如きフォーマットで記録される。同図中、PC1～PC8により1つのパックが構成されており、その8バイト目PC8はすべてパリティからなる。また、パックの1バイト目PC1から7バイト目PC7には、第2図に示す如くインターリーブされた下位2ビットの各データが記録される（ここでは1つのチャンネルのみ）。なお、第2図中、「は下位2ビットのデータであることを示し、また数字は1フレーム中の音声データの順番を示す。

次に、本実施例の再生系の動作について説明する。記録済磁気テープから回転ヘッドにより再生されたディジタル信号は、所定の公知の信号処理回路を経て第1図の復調回路17に供給され、10ビットの各データがもとの8ビットに復調されると共に、デインターリーブが行なわれた後、復号化回路18に供給されて誤り検出，誤り訂正などが行なわれる。

復号化回路18により復号された各データ中、前記PCM領域5に相当する記録領域から再生された、前記上位16ビットの各データはデータ結合回路19に供給され、一方、前記サブコード領域3a，3bに相当する記録領域から再生された前記下位2ビットの各データ、前記識別情報その他が中央処理装置15に供給される。また、前記PCM領域5に相当する記録領域から再生されたデータ中、第4図の同期信号の直後の2バイトW1，W2に相当する信号及び前記オプションコードエリアの信号は夫々予め決められたデータ伝送順序で再生されるから、自動的に中央処理装置15へ供給される。更に誤り検出結果により得られたエラーフラグも中央処理装置15へ供給される。

中央処理装置15は前記識別情報が入力されるときはそのときに入力される前記下位2ビットのデータをそのままスルーでデータ結合回路19に供給し、ここで復号化回路18よりの前記上位16ビットのデータの下位側に結合して18ビットのデータを生成させる。この18ビットのデータはもとの量子化ビット数18ビットの音声データであり、18ビットD／A変換器20に供給されてアナログ信号に変換された後、低域フィルタ（LPF）21により不要高周波成分を除去されて出力端子22へ出力される。

これにより、既存のDATに比べてより量子化ノイズの少ない高品質の再生音声信号を得ることができる。

また、前記オプションコードエリアから再生されたサブデータを中央処理装置15が解読して所定の信号を所定の回路や機構へ送出することにより、既存のDATと同様のサーチやアブソリュートタイム，プログラムナンバーの表示なども行なえる。

なお、中央処理装置15は前記下位2ビットのデータがエラーと判定したエラーフラグが入力されるときは、データ結合回路19へ下位2ビットとして予め設定した固定値（例えば"10"又は"01"）を供給する。この固定値を"10"又は"01"としたのは、もとの正しい下位2ビッ

トの値が“００”，“１１”のどちらであっても差を小さくするためである。

一方、前記上位１６ビットのデータがエラーと判定したエラーフラグが入力されるときは、中央処理装置１５は下位２ビットがエラーであるかないかに拘らず、前後の正しい１８ビット再生データに基づく補間動作をデータ結合回路１９で行なわせる。これにより、補間処理された１８ビットの音声データが１８ビットＤ／Ａ変換器２０へ出力される。

ところで、以上は本実施例の記録系により記録されたデータを再生した場合の動作であるが、この再生系により既存のＤＡＴで記録されたデータを再生する場合は、前記識別情報が存在しないので、中央処理装置１５は自ら生成した固定の２ビット“１０”（又は“０１”など）を下位２ビットとしてデータ結合回路１９に供給し、ここで復号化回路１８より取り出された量子化ビット数１６ビットの再生音声データの下位側に結合させる。

これにより、データ結合回路１９からは全体として量子化ビット数が１８ビットに拡大された再生音声データが取り出されて１８ビットＤ／Ａ変換器２０に供給される。従って、本実施例によれば、既存のＤＡＴにより記録された記録済磁気テープも支障なく再生することができる。

一方、本実施例により記録された記録済磁気テープを既存のＤＡＴで再生した場合は、上位１６ビットの各データがＰＣＭ音声データとして再生されると共に、前記識別情報によりサブコード領域からの再生信号が既存のＤＡＴ規格で定められた正規のものでないと検出されてそのサブコード領域再生信号が無視されることから、既存のＤＡＴと同程度の量子化ビット数１６ビットの音質で再生され、互換再生を確保できる。

発明の効果

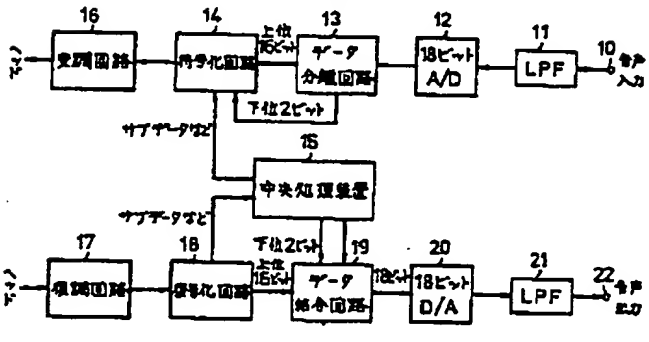
上述の如く、本発明によれば、既存のＤＡＴのもっている機能を劣化させることなく、それよりもより量子化ノイズが低減された高品質の再生音声信号を得ることができ、また識別情報が無いことによって既存のＤＡＴによる記録データも何の支障もなく再生できると共に、本発明による記録データも既存のＤＡＴにより従来と同程度の音質で再生することができ、互換再生を確保することができる等の特長を有するものである。

4. 図面の簡単な説明

第１図は本発明の一実施例のブロック系統図、第２図は本発明により下位２ビットの記録フォーマットの一例を示す図、第３図はＤＡＴによる記録トラック及びそのフォーマットを示す図、第４図は第３図のＰＣＭ領域の記録信号フォーマットを示す図、第５図は第３図のサブコード領域の記録信号フォーマットを示す図である。

１２…１８ビットＡ／Ｄ変換器、１３…データ分離回路、１４…符号化回路、１５…中央処理装置、１８…復号化回路、１９…データ結合回路、２０…１８ビットＤ／Ａ変換器。

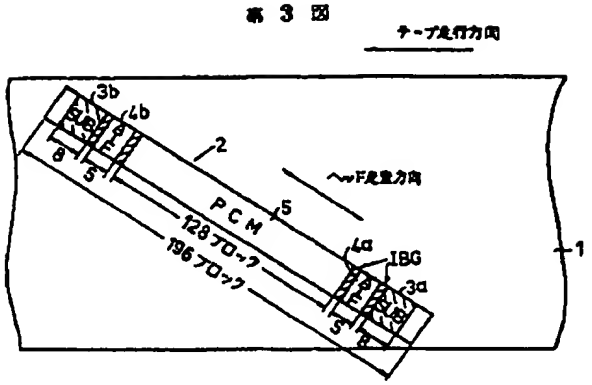
第１図



第２図

	2ビット	2ビット	2ビット	2ビット
PC 1	φr	52r	104r	156r
2	208r	260r	312r	364r
3	416r	468r	520r	572r
4	624r	676r	728r	780r
5	832r	884r	936r	988r
6	1040r	1092r	1144r	1196r
7	1248r	1300r	1352r	1404r
PC 8	パリティ			
	8ビット			

第 3 図



第 4 図

同期信号	W1	W2	パリティ	PCM音声データ・パリティ
8ビット	8ビット	8ビット	8ビット	256ビット(=32シンボル)

1ブロック, 288ビット

第 5 図

同期信号	SW1	SW2	パリティ	サブコードデータ パリティ
8ビット	8ビット	8ビット	8ビット	256ビット

1ブロック, 288ビット